

## Claims

What is claimed is:

1. A method for identifying signal sources, comprising:  
determining phase differential data for a signal stream, the signal stream corresponding to signal data from a single signal source; and  
applying wavelet packet processing to the phase differential data to generate a wavelet-based signature for the signal source.
2. The method of claim 1, further comprising acquiring data signals including combined signal streams from a plurality of signal sources; pre-processing the data signals to separate the data signals into a plurality individual signal streams, each individual signal stream being deemed to have originated from a single signal source; and using one of the individual signal streams for the determining step.
3. The method of claim 1, further comprising storing in a database wavelet-based signatures corresponding to known signal sources; and comparing the signature for the signal source with the stored data to determine if the signature for the signal source matches wavelet-based signatures stored for known signal source.
4. The method of claim 3, further comprising applying supplemental identification processing to the signal data to provide additional identification information for the signal stream.
5. The method of claim 4, wherein supplemental identification processing comprises Fourier transform processing that generates spectral coefficients, and wherein the stored data in the database further includes spectral coefficient signatures corresponding to known signal sources.
6. The method of claim 3, further comprising adding signature data to the database if the signal source is not found to match signatures of known signal sources stored in the database.
7. The method of claim 2, further comprising resampling the data signals at a selected sampling rate prior to the pre-processing step.

8. The method of claim 1, wherein the applying step comprising performing full wavelet packet decomposition into multiple levels to generate a plurality of decomposed nodes.
9. The method of claim 8, further comprising selecting a plurality of decomposed nodes and using wavelet coefficients for these selected nodes in generating the wavelet-based signature.
10. The method of claim 9, wherein the multiple levels is four levels.
11. The method of claim 10, wherein nodes 3, 7 and 16 are selected for use in generating the wavelet-based signature, the node numbers representing a numbering scheme where the first level nodes are numbered 1 and 2 from low to high; where the second level nodes are numbered 3, 4, 5 and 6 from low to high; where the third level nodes are numbered 7, 8, 9, 10, 11, 12, 13 and 14 from low to high; and the fourth level nodes are numbered 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29 and 30 from low to high.
12. The method of claim 11, further comprising encoding slopes for the selected 3, 7 and 16 nodes with binary codes and extracting a multi-dimensional feature vector for the signal stream.
13. The method of claim 12, further comprising storing in a database wavelet-based signatures corresponding to known signal sources; and comparing the signature for the signal source with the stored data to determine if the signature for the signal source matches wavelet-based signatures stored for known signal source.
14. The method of 13, wherein the comparing step comprises using Hamming distance as a criteria in testing the wavelet-based signature against the database.
15. The method of claim 14, further comprising applying supplemental identification processing to the signal data to provide additional identification information for the signal stream where more than one signal source in the database has the same Hamming distance with respect to the signal stream.
16. The method of claim 14, further comprising identifying the signal source as a new signal source where the smallest Hamming distance is above a selected value.

17. A signal source identification system, comprising:  
a phase pre-processing sub-system coupled to receive an individual signal stream, the phase pre-processing sub-system being configured to determine phase differential data for the individual signal stream; and  
a wavelet-based signal processing sub-system coupled to receive the phase differential data from the phase pre-processing sub-system, the wavelet-based signal processing sub-system being configured to apply wavelet packet processing to generate a signature for the individual signal source.
18. The signal source identification system of claim 17, further comprising:  
a data acquisition sub-system having data signals as an output, the data acquisition sub-system being configured to receive an input signal that includes combined signal streams from a plurality of signal sources; and  
a data pre-processing sub-system coupled to receive the data signals from the data acquisition sub-system; the data pre-processing sub-system being configured to separate the data signals into a plurality individual signal streams, each individual signal stream being deemed to have originated from a single signal source, and being configured to provide one of the individual signal streams to the phase pre-processing sub-system.
19. The signal source identification system of claim 17, further comprising:  
a database having stored data, the stored data including wavelet-based signatures corresponding to known signal sources; and  
a signal source identification sub-system coupled to receive the signature from the wavelet-based signal processing sub-system, the signal source identification sub-system being configured to compare the signature with the stored data and to determine if the individual signal source matches wavelet-based signatures of a known signal source.
20. The signal source identification system of claim 19, further comprising a supplemental identification sub-system coupled to receive data from the wavelet-based signal processing sub-system, the supplemental identification sub-system being configured to provide additional identification information for the individual signal stream.

21. The signal source identification system of claim 20, wherein the supplemental identification sub-system comprises Fourier transform processing that generates spectral coefficients, the spectral coefficients providing additional signature information, and wherein the stored data in the database further includes spectral coefficient signatures corresponding to known signal sources.
22. The signal source identification system of claim 19, wherein the signal source identification sub-system is further configured to add signature data to the database if the individual signal source is not found to match signatures of known signal sources stored in the database.
23. The signal source identification system of claim 17, wherein the wavelet-based signal processing sub-system is configured to perform full wavelet packet decomposition into multiple levels to generate a plurality of decomposed nodes.
24. The signal source identification system of claim 23, wherein the wavelet-based signal processing sub-system is further configured to use wavelet coefficients for selected nodes in generating the wavelet-based signature.
25. The signal source identification system of claim method of claim 24, wherein the multiple levels is four levels.
26. The signal source identification system of claim 25, wherein nodes 3, 7 and 16 are selected for use in generating the wavelet-based signature, the node numbers representing a numbering scheme where the first level nodes are numbered 1 and 2 from low to high; where the second level nodes are numbered 3, 4, 5 and 6 from low to high; where the third level nodes are numbered 7, 8, 9, 10, 11, 12, 13 and 14 from low to high; and the fourth level nodes are numbered 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29 and 30 from low to high.
27. The signal source identification system of claim 26, further comprising:  
a database having stored data, the stored data including wavelet-based signatures corresponding to known signal sources; and  
a signal source identification sub-system coupled to receive the signature from the wavelet-based signal processing sub-system, the signal source identification sub-system being

configured to compare the signature with the stored data and to determine if the individual signal source matches wavelet-based signatures of a known signal source.

28. The signal source identification system of claim 27, further comprising:
- a data acquisition sub-system having data signals as an output, the data acquisition sub-system being configured to receive an input signal that includes combined signal streams from a plurality of signal sources; and
  - a data pre-processing sub-system coupled to receive the data signals from the data acquisition sub-system; the data pre-processing sub-system being configured to separate the data signals into a plurality individual signal streams, each individual signal stream being deemed to have originated from a single signal source, and being configured to provide one of the individual signal streams to the phase pre-processing sub-system.